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ABSTRACT

A set of programs in liberal education designed to enhance the social dimensions of engineering education is described. This program requires a minimum of 36 quarter credits in the broad categories of English Composition (8-10 credits), Man and Society (12-15 credits), Artistic Expression (8-10 credits), and the balance from any of the above categories or from biological sciences and ecology. (MLH)

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AMERICAN SOCIETY FOR ENGINEERING EDUCATION

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TITLE OF PAPER: A Program in Social Sciences for Engineering Students

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Abstract: This paper describes a set of programs in liberal education designed to enhance the social dimension of engineering education.

1. Introduction: Under a grant from the Alfred P. Sloan Foundation to the Institute of Technology, a set of programs in liberal education designed to enhance the social dimension of engineering education has been formulated. The program is in its second year of operation.

The Institute of Technology bulletin states "Institute of Technology students, whatever their area of specialization, hold in common with all University students the search for liberal education - one which ennances their powers of judgment and choice. A liberal education implies awareness of the intellectual instruments for acquiring and communicating knowledge, primarily the instruments of language and structure, understanding of the ways in which engineers and scientists contribute to man's knowledge of

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himself and his environment, historical and philosophical perspective on the nature of the individual and society, and appreciation of the role of literature and the arts in the interpretation of life and nature."

The All-University Council on Liberal Education has established a minimum of 36 quarter credits in liberal education for all engineering undergraduate students. These credits must be earned in the broad categories of English Composition (8 - 10 credits), Man and Society (12 - 15 credits), Artistic Expression (8 - 10 credits) the balance coming from courses in any of the above categories or from biological sciences and ecology. Furthermore, the students are strongly urged to take courses which study the impact of science and technology on society and the environment.

The program then had to be designed with the purposes of meeting the All - University Council on Liberal Education guidelines and of taking maximum advantage of existing courses in various units of the university. The latter is an important consideration because courses that do not have a firm base in a specific unit tend to disappear after a few offerings. Wherever we have designed new courses, we have always made sure that it is under the aegis of an appropriate department in the University.

2. Description of Programs Rather than compiling a list of courses from which the student has to make a choice, we have organized the courses under 5 tracks. These tracks are, (i) Ecology, Technology and Society, (ii) Scarce Recources, Technology and Society, (iii) Communication, Computers and Society, (iv) Urban Problems and (v) Law and Society. Each of these tracks

contain a list of recommended courses and a supplementary list of courses that are relevant to that particular track. The course listings for each of the above tracks are given below.

Recommended Courses for the

ECOLOGY, TECHNOLOGY AND SOCIETY TRACK

FRESHMAN YEAR

[1]Comp 1001/1002	Intro to composition (4/4 cr)
[2]Geog 1401 f,w,s	Physical Geography (5 cr)

SOPHOMORE YEAR

EBB 3101 f,w	Ecology for Engineers and Social Scientists (4 cr)
Hum 3102/3103 w,s	The Meaning of Humanity (4/4 cr)

UPPER DIVISION

[3]SSci 3402 f,w,s	Ecology, Technology and Society (4 cr)
State 5021 f,w	Statistics with Social Science Applications (4 cr)
PA 5161/2 w,s	Technology Planning I-II (4/4 cr)
Hist 3823 f	United States in the 20th Century (4 cr)
IT 5931 w,s	Engineering for New Priorities (4 cr)
Geog 5811 w	Environment and the Quality of Life (4 cr)

1) Comm 1001/1002 is an acceptable substitute.

2) Geog 1301 or Pol 1031 are acceptable substitutes.

3) Could be taken in the Sophomore Year.

Recommended Courses for the

SCARCE RESOURCES, TECHNOLOGY AND SOCIETY TRACK

FRESHMAN YEAR

[1]Comp 1001/1002	Intro to composition (4/4 cr)
[2]Geog 1401 f,w,s	Physical Geography (5 cr)

SOPHOMORE YEAR

Geog 3351 s	North American Resource Management (4 cr)
Econ 3101 f,w,s	Microeconomic Theory (4 cr)
Econ 3655	Science, Technology and Economic Growth (4 cr)

UPPER DIVISION

PA 5151 w	Energy, Energy Policy (4 cr)
PA 5161/2 w,s	Technology Planning (4/4 cr)
Stat 5021 f,w	Statistics with Social Science Applications (4 cr)
Hist 3823 f	United States in the 20th Century (4 cr)
IT 5931	Engineering for New Priorities (4 cr)
IntR 5803	Steady State Earth (4 cr)

1) Comm 1001/1002 is an acceptable substitute.

2) Geog 1301 or Geog 1311 or Geo 1001 are acceptable substitutes.

Recommended Courses for the

COMMUNICATION, COMPUTERS AND SOCIETY TRACK

FRESHMAN YEAR

[1]Comm 1001/1002	Intro to composition (4/4 cr)
[2]Geog 1301 f,w,s	Human Geography (5 cr)

SOPHOMORE YEAR

CICS 3001 or N Sci 3201	Perspectives on Computers and Society (4 cr)
Hum 3102/3103 w,s	Meaning of Humanity (4/4 cr)

UPPER DIVISION

Pol 5328 w	Metropolitan Government and Politics (4 cr)
Jour 5721 w,s	Mass Media in a Dynamic Society (4 cr)
Stat 5021 f,w	Statistics with Social Science Applications (4 cr)
SSci 3981 f,w,s	Societies of the Future (4 cr)
IT 5931 w,s	Engineering for New Priorities (4 cr)
PA 5161/2	Technology Planning (4/4 cr)

1) Comm 1001/1002 is an acceptable substitute.

2) Geog 1311 or Hum 1009 or Spch 1103 are acceptable substitutes.

Recommended courses for the

URBAN PROBLEMS TRACK

FRESHMAN YEAR

[1]Comp 1001/1002	Intro to composition (4/4 cr)
Pol 1027 f,w	Urban Politics (4 cr)

SOPHOMORE YEAR

Hist 3832 f	United States in the 20th Century (4 cr)
SSci 3508/9	Problems of Urban Society (4/4 cr)

UPPER DIVISION

Hist 5354/5 f,w	American Urban History (4/4 cr)
Soc 5601 f,w	Urban Sociology (4 cr)
Stat 5021 f,w	Statistics with Social Science Applications (4 cr)
Soc 5605	Urbanization and Social Policy (4 cr)
IT 5931, w,s	Engineering for New Priorities (4 cr)
PA 5161/2 w,s	Technology Planning (4/4 w)

1) Comm 1001/1002 is an acceptable substitute.

Recommended List of Courses for the

LAW AND SOCIETY TRACK

FRESHMAN YEAR

Comp 1001/1002	Intro to Composition (4/4 cr)
Phil. 1003	Ethics (5 cr)

SOPHOMORE YEAR

Phil 3302	Moral Problems of Contemporary Society (5 cr)
Pol 3561	Intro. Legal Systems (4 cr)
Pol 3562	Intro. Legal Systems (4 cr)

UPPER DIVISION

(3 courses from the following)

Hist 5331	American Constitutional History (4 cr)
Hist 5332	American Constitutional History (4 cr)
Hist 5334	History of Civil Liberties and Civil Rights in the U.S.A.: Pre Industrial (4 cr)
Hist 5335	History of Civil Liberties and Civil Rights in the U.S.A.: Industrial (4 cr)
Jour 5777	Contemporary Problems in Freedom of Speech and Press (4 cr)
Pol 5501/5502	Principles of American Constitution (5/5 cr)
PA 5161/ w,s	Technology Planning (4/4 cr)

3. Some New Courses that have been Developed

Most of the new courses have a team taught format. This allows a fruitful combination of faculty from both engineering and liberal arts departments. A well integrated group has the additional benefit of future collaboration on teaching and research projects thus promoting an active interaction among the faculties of diverse departments.

a) Ecology, Technology and Society. This course has been eminently successful with an enrollment of nearly 100 students in each quarter of its offering. The course is team taught with faculty drawn from Political Science, Agriculture, Mechanical Engineering, History, and Biological Sciences. The main thrust of the course is to discuss the nature of the ecological problem, specific ecological issues such as air and water pollution, resource supplies, population growth and finally the prospects for solution through technological and government action. The implications of these actions on the society are discussed.

b) The Steady State Earth Seminar. The faculty comes from Engineering, Architecture, Biological Science and Economics. The elements of the interplay of population growth, food need and production, energy supply, mineral resource mobilization, environmental dynamics, human values and social institutions are presented in this seminar. The steady state model permits a recognition of the physical constraints which bound man's growth if long term (millenia) survival of a habitable earth is an agreed upon desideratum.

From this view the desirable directions for future growth can be recognized. The course is a true seminar in the sense that active discussion on vital problems is promoted and it has succeeded in doing this primarily because of the vitality of the main speakers.

c) Engineering for New Priorities. This course is again team taught with faculty coming from Engineering and Public Affairs. Processes by which plans for large scale engineering projects related to new priorities are implemented are discussed by examining several specific cases. The constraints imposed by social, environmental, economic and political considerations are integrated into the discussion. An unusual feature of this course is the student debates on specific topics. The topics that were discussed last year were, New Transportation Technology for Urban Areas, Breeder Reactors, Health Care Delivery Systems and New Cities of the Future. The students came from Law, Political Science, Biological Science and Engineering so that there was a good mix of different viewpoints.

d) Technology Planning. This sequence of 2 courses was designed by the School of Public Affairs to describe the relationship of science and technology to the ideological bases of our society, identification of technology's significance to the policy process and critical analysis of our society's institutions for governing its technologies. During the second quarter, the students are asked to take responsibility for special projects.

e) Public Issues of Nuclear Power. This series of lectures, which was video taped, involved participation of local and national critics, proponents and special experts in a setting which promoted an improved and discerning appreciation of the facts, experiences, and judgments regarding the advisability of continuing the development of the nuclear power industry. Participants included faculty from the university and invited speakers from the state and federal governments, consulting companies and utility industries. The topics were arranged so that there was a good balance between proponents and opponents of the nuclear power issue.

f) Knowledge and Power. This course is in its second quarter offering and has aroused the interest of both engineering and nonengineering students. It is a comparison of technology and natural science on one hand, with social science and applied social science, on the other hand. A wide variety of actual historical case studies in natural and social science, and in technology and social programs are examined to explore major issues in philosophy, ethics and political policy. The examples range from the steam engine to the space program, from psychological testing to the poverty program, and from electrical science to economics.

Some other courses that have been developed in Public Affairs and International Relations have not been included here for the sake of brevity.

4. Conclusions

The program to extend the social dimension of engineering education has taken the shape of a series of recommended courses in a given area of interest. Several new courses, taught in a team format, have been developed. In order to sustain the interest of faculty in a program like this, retreats are held each year to exchange ideas and discuss possible improvements. These retreats have proved to be very valuable, particularly in coming into serious contact with faculty from social sciences and thereby improving the chance for close collaboration.

We have tried to introduce new courses under the aegis of appropriate departments. We are also fortunate to have sympathetic department heads who do not consider team teaching loads as extra and thus many faculty members are encouraged to collaborate closely with colleagues from other disciplines.

We have had a very favorable response from industrial representatives regarding the desirability of engineering students following one of the programs described earlier. Most said, however, that the job assignments and advancement would depend on technical competence almost exclusively. We have plans to observe the impact of this program by obtaining feedback from students after they have graduated and gone on to take employment.

One feature of the program which is not discussed here is the joint graduate degree (Master's) program between the engineering departments and the School of Public Affairs.

5. Acknowledgements.

Thanks are due to the Alfred P. Sloan Foundation whose generous grant made this all possible. The encouragement of R.A. Swalin, Dean of the Institute of Technology, has been a great asset to the formulation and implementation of this program. There are too many people who deserve credit for designing, teaching and improving courses but special mention must be made of my faculty colleagues John Turner and Paul Reynolds.